**Babcock & Wilcox**

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April 19, 1991

Mr. J.W. Scofield
Department of Water & Power
City of Los Angeles
111 N. Hope Street
Room 604
Los Angeles, CA 90051

Re: Intermountain Power Project
Burners

Dear Mr. Scofield:

As a result of our jobsite meeting and my subsequent meeting in Barberton, I would like to offer the following suggested plan of action for burner condition assessment and rehabilitation. I have divided the issues into categories of design, operation and air systems, in an attempt to organize this effort.

Burner Design

All recent reports on condition have been reviewed by our design staff, including recommendations by EER and W.E. Newkirk, Consultant. As a result, a design review was undertaken specifically to evaluate thickness changes, material upgrades, and configuration changes to reduce stresses. Our initial findings are as follows:

1. Our stress engineers advise that strength increases by a power between two and three as the thickness changes. Thus, incremental increases in thickness appear to be very beneficial. We are in the process of preparing a drawing that shows the proposed changes to the components for future review.

2. There appears to be a disagreement between parties involved on the benefit of material changes. As you are aware, B&W has participated over the decades with determination of allowable stresses for steel alloys in high temperature service. For equipment in non-pressure part service, we utilize allowable stress levels based on our experience and research. The result is that we see no advantage to 309 series stainless, and in fact show higher allowables for 304. Please realize that others utilize allowables that are different, and the issue is then whose data base do you believe to be most accurate. However, should a major rehab occur, we will recommend a material, but would be pleased to fabricate components per your specification.

3. Our designers have studied the problem of register back plate dishing due to radiate heat on the furnace side. They advise that one critical aspect of the DRB is the positioning of the outer air register with respect to the coal nozzle. The idea of moving the register away from the furnace would then require moving the coal nozzle also, and functionally, this is not desirable. What is needed, and we believe we have a first cut solution for, is a design that allows the plate to grow without significant distortion. This would both relieve the need to trim register doors, improving the functionality of the outer registers, and also reduce the loads transmitted to other components. A drawing showing this change is being prepared for future review.

4. There is consensus that the HD register design is superior, and this would be recommended on any future retrofit. However, we recommend against splitting the registers for installation. What this means is that the burner would need to be pulled from the windbox for installation of the HD assembly. This requirement, coupled with thickness changes and expediting installation (minimize labor and outage time), leads to the conclusion that a replacement assembly may be the optimum approach. Some equipment, such as lighters, scanners, nozzles, etc. would be reused. We will proceed to evaluate the shop versus field variables to determine an optimum solution.

As you can see, B&W is giving this serious thought and making strides toward solutions. I expect the drawings to be ready soon, such that it may be transmitted prior to the jobsite meeting in May where comments may be heard.

Operations

There are several operating parameters, for both in service and out of service conditions, that impact burner performance and condition. At times, these parameters conflict, most notably the impact of excess air on heat rate versus the quality of out of service burner cooling. The following are offered for consideration.

1. All burners have now been thermocoupled and temperatures made available to the operators. We strongly urge that the alarm temperature levels, currently 1350°F (back plate) and 1050°F be avoided. Depending on the compartment, this may require increasing excess air levels to accommodate. Please note that the concern is not that we are any where near material use limits, but is to reduce thermal stresses. Also, burner metal temperatures should be routinely logged for review. B&W requests that these logs (at least hourly readings for all TC's) be forwarded to our Denver office on a regular basis for review. This information will also be used by design personnel in their efforts. —Comp Serv.

2. Coal nozzle fires continue to be a major problem, and there are three areas that need investigation. First, of course, is confirmation of adequate PA flow to all burners. We stand ready to assist IPSC in this effort. A second possibility is coking of the nozzles. This initially occurs when a coal stream is admitted to a "hot" nozzle. Coal particles will stick, and after devolatilizing, burn as carbon. This coke then provides a surface for additional particles to adhere, and the process continues while generating high temperatures. Thus, when placing a compartment in service it is desirable to provide cooling with as lean a mixture as possible to reduce the possibility of coking. The third possibility is in the presence of large eyebrows. It is possible that at some point the eyebrow drops over the burner to sufficiently disturb recirculation patterns with subsequent combustion problems in the burner. A serious effort to eliminate this problem should be undertaken immediately. I recommend that IPSC begin by documenting the locations and damages of nozzle fires to-date. — GC

3. Eyebrow formation continues to be a nuisance. It is believed that eyebrows form from excessive angular momentum in the inner air, and from outer air recirculation patterns that are in contact with the furnace walls. It is recommended that burner adjustment be made in increments, to reduce spin while increasing outer air flows. This effort should be in concert with a planned visit by the writer and our chief burner designer to observe operations. Also of note, slagging tends to increase in reducing atmospheres, which will be present with compartment out of service while maintaining 17% excess air levels. This type of operation again needs to be reviewed in view of heat rate penalties. It is also recommended that the AGASS system be in service prior to this effort.

4. Burner balancing has routinely been performed, utilizing AGASS, with the goal of a uniform $O_2$ distribution at the economizer outlet. Generally, this has resulted in reductions in air flow to inboard burners to push more air toward outboard burners. While this is good for burners in service, it is proving a detriment to inboard burners when out of service. It is suggested that a non-uniform, or "humped" pattern may be more appropriate for all conditions. Additionally, burner pressure drop should be maintained at 2.5 inches w.g. to assist in compartment air flow distribution. This will require a uniform reduction in register and air disk openings.

These four items have been discussed before, and I suggest that they now be pursued with vigor. We would be pleased to assist in an IPSC coordinated effort to pursue these items or other burner operation problems brought forth by IPSC.

Air Flow Distribution/Systems

Concern has been recently raised of air flow distribution problems, both compartment to compartment and burner to burner. The following comments are directed toward this concern.

1. Flow modeling is one possibility to evaluate overall and compartment air distribution. This could be utilized to see if certain operating modes result in particularly troublesome distributions. The model could also be used to locate turning vanes, other distribution devices, and/or air flow metering stations. Flow modeling, however, can be expensive. A unit of this size would likely require $75,000.00 to model the ductwork from the air heater air outlet, the windbox compartments and the lower furnace. This option requires further thought and consideration.

2. There is a general consensus that compartment air metering would be beneficial. To further study this, we are developing possible arrangements utilizing air foils or pitot tube arrays. We currently favor the air foil (when properly designed and constructed). We recently completed a long term evaluation of a pitot tube array with the owner requesting replacement with air foils. These conceptual drawings with budget pricing should be available for our May meeting. This would add about 1.29" of resistance while providing a 2.5" signal.

3. Velocity traversing may be used to characterize distribution problems. However, it becomes difficult, if not tedious, to traverse all desired locations under all conditions such that meaningful conclusions may be drawn. Many hours can be expended prior to accumulation of meaningful data, and the costs must be weighed against modeling costs. I suggest this item be further studied prior to implementation.

This letter summarizes our current position for addressing burner problems. I would recommend that IPSC, and any other interested party, also summarize their experience, ideas and/or concerns. Our purpose for the jobsite meeting would then be to integrate these plans and reach consensus. A unified strategy with schedule and decision trees would then be prepared for presentation to management.

Please give this your consideration and advise any comments.

Very truly yours,

BABCOCK & WILCOX COMPANY

D.C. Langley
Regional Service Manager
Western Region

DCL:pm/350

RJM
air/coal modeling

Concerns:

extensive tuning (3-6 months)
Access / manpower
Is it cost effective when replacing 1 in 12-18 months (burners)

put together IPSC gameplan / schedule

Need Recommendations from RJM
nesting competitive #

Issues: make sure address all
→ cooling air
→ necessary air flow?